

Public Health Assessment for

FRIDLEY COMMONS PARK WELL FIELD

FRIDLEY, ANOKA COUNTY, MINNESOTA

CERCLIS NO. MND985701309

SEPTEMBER 29, 1999

US EPA RECORDS CENTER REGION 5



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U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry

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THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

Section 104 (i) (7) (A) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, states "...the term 'health assessment' shall include preliminary assessments of potential risks to human health posed by individual sites and facilities, based on such factors as the nature and extent of contamination, the existence of potential pathways of human exposure (including ground or surface water contamination, air emissions, and food chain contamination), the size and potential susceptibility of the community within the likely pathways of exposure, the comparison of expected human exposure levels to the short-term and long-term health effects associated with identified hazardous substances and any available recommended exposure or tolerance limits for such hazardous substances, and the comparison of existing morbidity and mortality data on diseases that may be associated with the observed levels of exposure. The Administrator of ATSDR shall use appropriate data, risk assessments, risk evaluations and studies available from the Administrator of EPA."

In accordance with the CERCLA section cited, ATSDR has conducted this preliminary health assessment on the data in the site summary form. Additional public health assessments may be conducted for this site as more information becomes available to ATSDR.

The conclusions and recommendations presented in this public health assessment are the results of site-specific analyses and are not to be cited or quoted in other evaluations or public health assessments.

PUBLIC HEALTH ASSESSMENT

FRIDLEY COMMONS PARK WELL FIELD

FRIDLEY, ANOKA COUNTY, MINNESOTA

CERCLIS NO. MND985701309

Prepared by:

**Minnesota Department of Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry**

FOREWORD

This document summarizes potential public health concerns at the Fridley Well Field, Fridley, Minnesota. It is based on a formal site evaluation prepared by the Minnesota Department of Health (MDH). A number of steps are necessary to do such an evaluation:

- **Evaluating exposure:** MDH scientists begin by reviewing available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it's found on the site, and how people might be exposed to it. Usually, MDH does not collect its own environmental sampling data. We rely on information provided by the Minnesota Pollution Control Agency (MPCA), U.S. Environmental Protection Agency (EPA), and other government agencies, businesses, and the general public.
- **Evaluating health effects:** If there is evidence that people are being exposed—or could be exposed—to hazardous substances, MDH scientists will take steps to determine whether that exposure could be harmful to human health. The report focuses on public health—the health impact on the community as a whole—and is based on existing scientific information.
- **Developing recommendations:** In the Public Health Assessment (PHA), MDH outlines its conclusions regarding any potential health threat posed by a site, and offers recommendations for reducing or eliminating human exposure to contaminants. The role of MDH in dealing with hazardous waste sites is primarily advisory. For that reason, the PHA will typically recommend actions to be taken by other agencies—including EPA and MPCA. However, if there is an immediate health threat, MDH will issue a public health advisory warning people of the danger, and will work to resolve the problem.
- **Soliciting community input:** The evaluation process is interactive. MDH starts by soliciting and evaluating information from various government agencies, the organizations responsible for cleaning up the site, and the community surrounding the site. Any conclusions about the site are shared with the groups and organizations that provided the information. Once a PHA has been prepared, MDH seeks feedback from the public. *If you have questions or comments about this report, we encourage you to contact us.*

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Table of Contents

Introduction	1
Background	1
A. Site Description and History	1
B. General Regional Issues	2
C. Site Visit	3
D. Demographics Land Use, and Natural Resources Use	3
E. Community Involvement	3
Environmental Contamination and Other Hazards	3
Evaluation of Contamination and Exposure	6
Agency for Toxic Substance and Disease Registry Child Health Initiative	7
Conclusions	8
Recommendations	9
Public Health Action Plan	10
Glossary	11
References	12
Figures	13

INTRODUCTION

The Minnesota Department of Health (MDH), under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), has completed this Public Health Assessment (PHA) evaluate the public health significance of potential exposure to contaminants found at the Fridley Commons Well Field superfund site. ATSDR, located in Atlanta, Georgia, is a federal agency within the U.S. Department of Health and Human Services. ATSDR is mandated by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended by Superfund Amendments and Reauthorization Act (SARA 1986) to conduct a public health assessment at each site proposed for or listed on the National Priorities List (NPL).

The subject of this public health assessment is the municipal well field owned and operated by the City of Fridley. This document examines contaminated media (water, air and soil), transport mechanisms and routes of exposure (ingestion, inhalation and dermal contact) to determine the likelihood of individuals being exposed to contamination. The PHA determines whether health effects are possible and makes recommendations to reduce or prevent possible health effects.

This Public Health Assessment is based on site file reviews and information gathered during a site visit. It contains a summary of information obtained from the City of Fridley, Minnesota Pollution Control Agency (MPCA) and its contractor Barr Engineering Corporation (Barr) and conclusions and recommendations by MDH. This Public Health Assessment discusses data and results collected prior to September 1999.

BACKGROUND

Site Description and History

The Fridley Commons Park Well Field is a 50 acre site with eight active public wells (numbered 2,3,4,5,6,7,8, and 9), owned by the City of Fridley. The well field serves a population of approximately 29,000. The Site is located within the city of Fridley, Anoka County, Minnesota, approximately one mile north-northwest of the intersection of Interstate Highway 694 and Minnesota State Highway 65 (Figure 1). The Site is approximately one mile east of the Mississippi River, approximately one mile east from the federally designated Mississippi National River Reach and Recreation Area, and approximately 0.2 miles northwest of Moore Lake. The Commons Park provides recreational activities, and land use in the area surrounding the Site is mostly residential, with some areas of commercial and industrial use.

The City operates eight municipal water supply wells (wells 2,3,4,5,6,7,8, and 9) and a water treatment plant (Commons Park Treatment Plant/Plant #1) at the Site. Four of the wells are open to the Prairie du Chien-Jordan (PdCJ) aquifer and four wells are open to the Mt. Simon Hinkley aquifer (See Table 1). Water from seven wells is blended and treated at Plant #1. Well 9 was taken out of service in November 1989, because high concentrations of Trichloroethylene (TCE) were measured(1). A recent state-funded evaluation report has indicated that if the contaminant

levels remain the same or increase, the City's blended water will exceed the maximum contaminant level (MCL) when the four contaminated wells must be used during periods of peak demand.

At the Commons Park Well Field, water from the Mt. Simon Hinkley wells (2,3,4, and 5) are manifolded together (blended) and sent into filters 7,6, and 5. Filters 6 and 7 are designed for removing iron and suspended solids found in the Mt. Simon Hinkley aquifer. Water from the Jordan wells are manifolded together into filters 4, 3, 2, and 1. Filters 1-5 contain green sand and Anthracite which is used to remove dissolved iron and manganese. Water from all wells in use are manifolded together and treated with chlorine and fluoride before being sent to the ground storage and elevated tank reservoirs for distribution into municipal system (Figure 10).

General Regional Issues

A MPCA file search conducted by Barr Engineering Co. has located the following TCE release sites within a two mile radius of the site: Boise-Onan-Meditronic, Naval Industrial Reserve Plant/FMC, Kurt Manufacturing, Dealers Manufacturing (1). However, none of these TCE impacted sites has been established as the source of the contamination at Commons Park Well Field. It is thought that Kurt Manufacturing has contributed to the TCE and PERC groundwater plume impacting Fridley well 13 (6). Contaminants of concern associated with the Kurt include solvents tetrachloroethylene (PERC), 1,1,1-trichloroethane (TCA), and 1,2-dichloroethane (DCE) (6). Kurt Manufacturing is on the federal National Priorities List (NPL).

A number of Prairie du Chien-Jordan wells within a 2 mile area of the Site have been analyzed for TCE; and only a few have indications of TCE contamination. Approximately 11 wells have been identified within a two mile radius as being contaminated with volatile organic compounds (VOCs). The wells which have TCE contamination include: the Fridley Middle School which is adjacent and southeast of the Site; Stylmark, less than ½ mile northeast of the Site; MPCA #3, greater than a mile east-southeast of the Site; and Kurt Manufacturing and NIROP both about 1 mile south-southwest of the Site (see Figure 15). The source of the TCE plume which affects the Commons Park Well field is unknown. Three Prairie du Chien-Jordan monitoring wells were drilled in May 1994 in an attempt to identify potential contamination sources (figure 14). TCE analysis of water from these wells has been negative.

Generally, the Prairie du Chien-Jordan aquifer is believed to flow toward the Mississippi River (west-southwest) in the area of concern. In the vicinity of the Site the Prairie du Chien-Jordan is believed to contain significant numbers of bedding planes, joints, fractures, and solution cavities. Proximal location of specific wells in relation to these geological irregularities could significantly affect the flow dynamics of a plume in the aquifer. Therefore, the construction of a groundwater model may be necessary to determine potential TCE reservoirs or sources.

Site Visit

Lisa Pogoff (MDH Health Educator) and Daniel Peña (MDH Health Assessor) joined Bob Smude (MDH Public Water Supply Unit) during one of the quarterly monitoring events at the city of Fridley municipal water system on May 18, 1999. Water samples were collected at each of the City's water treatment facility effluents: Commons Park Well Field (treatment plant 1), Locke Park (treatment plant 2), and treatment plant 3. A tour of each facility was conducted.

Demographics, Land Use, and Natural Resources Use

The City of Fridley occupies 9.906 square miles in Anoka County and has a population of 28,335 (1998 estimate). The Fridley Commons Well Field is surrounded by residential property. To south of the Site is Fridley High School and Fridley Community Education Center. In the southeast corner of the Well Field is Fridley Middle School and Moore Lake (see Figures 13 and 14).

A search of the MDH County Well Index data base has identified 15 private domestic wells within a two mile radius of the Commons Park Well Field (1). Six public supply wells have been identified within a two mile radius. A public supply well is well that serves the public but is not a municipal well. The public wells usually belong to a business, school, or any other entity that serves the public, but is not a residence. Fridley High School and Fridley Middle School each have a public well within a 1000 feet of Commons Park Well Field. However, both schools are connected to municipal water and the wells are used for irrigation.

COMMUNITY INVOLVEMENT/COMMUNITY HEALTH CONCERNS

At this point in the investigation of Fridley Commons Park Well Field, there has been no community involvement. A community relations plan is being drafted for the site by the MPCA which will include plans for community involvement as required by Superfund policies.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

Trichloroethylene (TCE) was first detected in Well #9 in 1984. Subsequent tests of wells have revealed low level VOC contamination of Wells #6 thru #9. Well #9 has consistently had the highest concentrations of TCE. TCE concentrations found in Well #9 have often been above the MCL of 5 micrograms per liter ($\mu\text{g/L}$). TCE has been detected in well water from: Well #9 at up to 79 $\mu\text{g/L}$ (4/9/92); Well #8 up to 17 $\mu\text{g/L}$ (10/3/91); Well #7 up to 29.7 $\mu\text{g/L}$ (6/9/92); and Well #6 up to 9.2 $\mu\text{g/L}$ (11/1/90) (See Figures 2-5). In November 1989, Well #9 was removed from service when blended water from the well field was found to contain concentrations of TCE above the MCL. Since all Prairie du Chien-Jordan wells in the well field have exhibited TCE contamination, the City has attempted to decrease reliance on those wells (1). It has been

demonstrated that the concentration of TCE found in each well is generally related to the pumping volume(1). As pumping increases, so does TCE concentrations (See Figures 6-8). Figure 9 illustrates that TCE concentrations remain above the MCL even though the well is not being used. Therefore, while the contamination in Well #9 has decreased since it was taken off line, it is anticipated that if it is used as a supply well in the future, the concentration of TCE will return to previous levels. In addition, continual use of wells 6,7, and 8 can potentially cause the TCE plume to migrate to these wells and render them unfit for municipal use without treatment.

Table 1

Fridley Commons Park Well Field Wells Specification Table		
Well # /Unique I.D. #	Water Bearing Formation	Well Depth
Well 2 / 206674	Mt. Simon Hinckley	842
Well 3 / 206670	Mt. Simon Hinckley	840
Well 4 / 201158	Mt. Simon Hinckley	830
Well 5 / 206675	Franconia Hinckley	845
Well 6 / 206673	Prairie du Chien-Jordan	250
Well 7 / 206678	Prairie du Chien-Jordan	262
Well 8 / 206669	Prairie du Chien-Jordan	265
Well 9 / 206672	Prairie du Chien-Jordan	262

At the Commons Park Well Field, water from the Mt. Simon Hinkley wells (2,3,4, and 5) are manifolded together (blended) and sent into filters 7,6, and 5. Filters 6 and 7 are designed for removing iron and suspended solids found in the Mt. Simon Hinkley aquifer. Water from the Jordan wells are manifolded together into filters 4, 3, 2, and 1. Filters 1-5 contain green sand and Anthracite which is used to remove dissolved iron and manganese. Water from all wells in use are manifolded together and treated with chlorine and fluoride before being sent to the ground storage and elevated tank reservoirs for distribution into municipal system (Figure 10). The highest concentration of TCE found in the distribution system was 4.9 ug/l on July 7, 1992 at the Fridley Middle School (1).

The City also operates 5 other wells (wells 1, 10,12, and 13) that are not located at the Commons Well Field (Figure 1). See figure 11 for treatment plant layout for wells 10 and 11 (Plant 2). Figure 12 illustrates how wells 1, 13, and the New Brighton Water Connection are introduced to the municipal system. Well 13 has been vulnerable to TCE, chloroform, and carbon tetrachloride since the late 1980s as noted in a MDH Health Assessment for Kurt Manufacturing (6). The chloroform HRL is 60 ug/l and the carbon tetrachloride is 3ug/l (See section Evaluation of

Contamination and Exposure for explanation of HRLs). Table 2 list recent detections of contaminants found in well 13. Well 13 is only used only occasionally during peak periods in the summer months. In 1997, 872,000 gallons were pumped from this well (10). In 1998, 53,000 gallons were pumped from well 13 (10). When well 13 is used, it is treated with chlorine and fluoride and pumped directly into the distribution system. Because of this mechanical setup, it is possible that some municipal water users may receive mixed water (commons park and well 13 water). Other residence may receive primarily well 13 water with little or no dilution with other water in the system. This may be a problem if well 13 contaminant concentrations increase above drinking water criteria. In any case, exposure to contaminants in well 13 will be intermittent based on past well use.

Table 2

Fridley Well 13 Volatile Organic Compound Detections			
Date	Compound (ug/l)	Maximum Contaminant Level (ug/l)	Health Risk Limit (ug/l)
9/6/1995	Carbon tetrachloride 0.4	5	3
9/6/1995	cis-1,2-Dichloroethylene 0.5	70	70
9/6/1995	Chloroform 0.3	100	60
9/6/1995	Trichloroethylene 1.0	5	30
10/26/1995	Carbon tetrachloride 0.3	5	3
10/26/1995	Chloroform 0.1	100	60
10/26/1995	Trichloroethylene 0.3	5	30
2/16/1996	Trichloroethylene 0.2	5	30
5/6/1997	Chloroform 0.4 ug/L	100	60

The City receives some water from New Brighton via an interconnect when a surplus is available. However, during the summer, the peak usage period, the interconnect does not supply a significant amount of water to Fridley. Therefore, during the summer months it is necessary for the City to use large amounts of blended water from contaminated wells to maintain supplies (1). Currently the City is attempting to determine the extent and severity of the TCE contamination and to identify sources of clean water so that they can match anticipated need in the future.

The Preliminary Assessment (PA), was completed by Minnesota Pollution Control Agency (MPCA) staff and was approved by the EPA on September 20, 1991. A Screening Site

Inspection (SSI) was conducted by MPCA staff on November 5 and 6, 1991. The SSI report, submitted to EPA and approved on July 6, 1992, recommended the Site for an Expanded Site Inspection (ESI). The Site was added to the State of Minnesota's Permanent List of Priorities, or State Superfund List, in June 1992. The 1996 ESI recommended listing on the NPL and more effort to define the source within the limitations of cost.

The Fridley Commons Well Field was listed as National Priority List (NPL) superfund site on January 19, 1999. The MPCA conducted a responsible party search and submitted their findings to the Environmental Protection Agency (EPA). No responsible party has been identified. A remedial investigation and feasibility study has not been conducted. The MPCA is currently in the process of applying for federal funds to conduct a site investigation and cleanup.

Evaluation of Contamination and Exposure

On the basis of MDH's review and evaluation of environmental information collected from the MPCA Site file, MDH records, and a site visit, MDH concludes that the current contaminant exposure levels from drinking water do not pose a current public health hazard. MDH has determined that a complete exposure pathway via drinking water exists for TCE. TCE concentrations are monitored along with 41 other volatile organic compounds at Fridley Municipal Water Treatment Plants as part of their water quality monitoring program. After the ground water is treated, it is distributed to approximately 29,000 people in Fridley.

Because low levels of TCE have been detected in Fridley municipal water, residents who use this water are being exposed to TCE via ingestion (cooking and drinking), inhalation (cooking and bathing), and dermal contact. MDH considers TCE to be a probable human carcinogen. MDH has determined a Health Risk Limit (HRL) for TCE of 30 $\mu\text{g/L}$. MDH associates a negligible health risk with the ingestion of water containing a hazardous chemical at a concentration which is less than the HRL. The calculation of the HRL assumes that an individual drinks 2 liters of water per day from the contaminated source. A negligible health risk is defined by MDH as the incremental addition of less than 1 incidence of cancer in 100,000 exposed individuals exposed for a lifetime. MCLs, on the other hand, are maximum concentrations of hazardous chemicals allowed by federal law in municipal drinking water. The HRLs are strictly health based. MCL calculations also factor in chemical specific characteristics such as detection limits and ease/cost of treatment. In the case of TCE, the MCL is less than the HRL. Sometimes the HRL is lower than the MCL for the same reasons mentioned above.

HRLs for contaminants that are classified as non-carcinogens are calculated using a formula which includes a "relative source contribution factor." This factor helps to account for the fact that not all of an individual's exposure to some types of contaminants comes only from drinking contaminated water. Other pathways, such as inhalation, skin contact, or eating food containing the contaminant can also contribute to the amount of individual exposure. For non-carcinogens this is directly accounted for through the "relative source contribution factor." HRLs for contaminants which may be associated with an increased cancer risk in humans (including TCE

and CCl_4) do not include this factor directly in the HRL calculation. However, other adjustments account for this. In addition, the carcinogenicity of TCE is also currently being re-evaluated, and there is some scientific debate as to whether or not it is a carcinogen.

Studies have shown that exposure to VOCs in drinking water through inhalation or skin contact during such activities such as showering, bathing, or washing dishes can be significant in certain situations. The ratio of inhalation uptake versus direct ingestion of contaminated water has been estimated to be as high as 6:1 (McKone 1989) or as low as less than 1:1 (Lindstrom and Pleil 1996). A variety of variables influence uptake making accurate estimates very difficult. These variables include such things as water temperature, size of the shower enclosure, the type of shower head used, length of time spent in the shower, and the ventilation rate. Several studies have demonstrated that simply ventilating the shower stall can greatly reduce the estimated exposure to VOCs in shower air (McKone and Knezovich 1991; Aggarwal 1994).

Agency for Toxic Substance and Disease Registry (ATSDR) Child Health Initiative

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children make them of special concern to communities faced with contamination of their water, soil, air, or food. Children are at greater risk than adults from certain kinds of exposures to hazardous substances. Often health risk calculations, including the MCLs and HRLs, do not include values for children. They are shorter than adults, which means they breathe heavy vapors that may collect close to the floor. Children are also smaller, resulting in higher doses of chemical exposure per body weight. The developing organ systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

At the present time, child exposure to levels of VOCs in excess of MCLs is not occurring from municipal water. Exposure of children to TCE in drinking water at levels below the MCLs is likely occurring at most residences. However, as stated above, MDH believes that the TCE MCL is conservative and protective of human health, including children.

PATHWAYS ANALYSES

Current Pathways

Air (indoor): No TCE indoor air quality data has been collected. It is likely that inhalation of TCE would occur mostly while showering, and to a lesser extent while bathing. Factors like water temperature, room size, TCE water concentrations, and whether the water is standing or sprayed will influence TCE inhalation exposure. Because the TCE water concentrations are considerably below the TCE HRL, exposure to TCE via inhalation is not a current health hazard.

Soil: This is not a relevant pathway for the Commons Well Field site.

Groundwater: Contaminated groundwater is significant pathway leading to ingestion and dermal contact with TCE. Cooking, cleaning, and drinking, municipal water from Commons Park Well Field and Well 13 will result in TCE exposure. Because the TCE municipal water concentrations are well below the TCE HRLs, current exposure is not of health concern. Any additive effects of other contaminants detected in Well 13 are not a health concern either based on current contaminant concentrations and well use.

Potential Future Pathways

If future activities at Commons Park Well Field include excavation within the contaminant plume or source area(s), exposures may occur via inhalation of soil gases and/or dermal contact.

In general, potential future pathways will remain the same as they are now (ingestion, inhalation, and dermal contact) except that concentration could increase above the MCLs and HRLs resulting in a possible health risk. Another future exposure scenario is via volatilization of soil gases from source areas into nearby buildings. However, no source areas have been identified.

CONCLUSIONS

On the basis of MDH's evaluation of available environmental information collected during the Preliminary Assessment (PA), Screening Site Inspection (SSI), Expanded Site Inspection (ESI), and a review of MDH site files, MDH reached the following conclusions and assigned public health conclusion categories.

MDH determined that Fridley Commons Park Well Field and Well 13 drinking water pose *no current human health hazard based on data reviewed*. However, the potential for contaminants to exceed the MCLs at anytime is possible in well 13 and to a lesser extent at Fridley Commons Park Well Field effluent.

- Wells 6,7,8, and 9 are similar in depth and are relatively close to each other.
- Well 9 was taken out of service in November 1989 for having high concentrations of Trichloroethylene (TCE)
- Continued pumping of well 6,7, and 8 may render them unusable if the TCE plume continues to be influenced by their pumping. These wells are currently contaminated with low levels of TCE.
- The Commons Park Treatment Plant layout allow for maximum mixing of contaminated well water (wells 6,7,and 8) with uncontaminated well water (wells 2-5)

- **Fridley Well 13 is contaminated with TCE, carbon tetrachloride, and cis-1,2-dichloroethylene. However it has not exceeded any MCLs or HRLs based on the data reviewed for this report**
- **Well 13 is pumped directly into the distribution system without treatment for VOCs**
- **Who receives water from well 13, when it is in service, has not been determined**
- **The monitoring schedule for well 13 has not been determined.**
- **A comprehensive well receptor survey has not been conducted.**
- **It has not been determined if any notification of possible contamination has been sent to private well owners identified in within a mile of the site**
- **The complex hydrogeological setting at Fridley Commons Well Field may make it cost prohibitive to locate TCE source areas**

RECOMMENDATIONS

- **An alternate source of water needs to be located to replace wells 6, 7, 8, and 13 if they become unusable.**
- **A comprehensive well receptor survey for private wells within a one mile radius of the site, identification of current well water use, and notification of well owners of possible contamination should be done.**
- **Monitoring at well 13 should be increased if it is not adequate**
- **Areas in the distribution system most likely to receive undiluted well 13 water should be identified.**
- **A water safety plan which will determine how long water reservoirs will last if wells 6,7,8, and 13 become unusable should be accomplished.**

PUBLIC HEALTH ACTION PLAN

Minnesota Department of Health will follow up on the recommendations in this report. A more detailed public health action plan will be developed once community concerns have been identified.

Preparer of Report

**Daniel Pena
Minnesota Department of Health**

GLOSSARY

Areas of Concern	(AOC)
Air Soil and Water	(A,S,W)
Agency for Toxic Substances and Disease Registry	(ATSDR)
Comprehensive Environmental Response, Compensation, and Liability Act	(CERCLA)
Contaminants of concern	(COC)
County Well Index	(CWI)
U. S. Environmental Protection Agency	(EPA)
Federal Safe Drinking Water Act	(FSDWA)
Health Risk Limits	(HRLs)
Maximum Contaminant Levels	(MCL)
Minnesota Department of Health	(MDH)
Microgram per Liter	($\mu\text{g/l}$)
Minnesota Environmental Response And Liability Act	(MERLA)
Minnesota Pollution Control Agency	(MPCA)
Minimal Risk Levels	(MRL)
Minnesota Well Code	(MWC)
National Priority List	(NPL)
tetrachloroethylene	(PERC)
Public Health Assessment	(PHA)
Parts Per Million	(ppm)
Resource Conservation And Recovery Act	(RCRA)
Record of Decision	(ROD)
Superfund Amendments and Reauthorization Act	(SARA 1986)
Soil Reference Values	(SRVs)
semivolatile organic compounds	(SVOC)
Trichloroethylene	(TCE)
Volatile Organic Compounds	(VOCs)

References

- 1) **Evaluation of Groundwater Contamination Fridley Commons Well Field Site. Prepared for the Minnesota Pollution Control Agency. March 1997**
- 2) **Expanded Site Inspections Report, Fridley Commons Park Well Field. Minnesota Pollution Control Agency. October 1995.**
- 3) **Fridley Commons Park Well Field Site File. Minnesota Pollution Control Agency. June 1999.**
- 4) **Fridley Commons Park Well Field Site File. Minnesota Department of Health Community Water Supply Unit Files. July 1998.**
- 5) **Project Narrative Statement Fridley Common Park Well Field. Minnesota Pollution Control Agency Site Files. July 1999.**
- 6) **Kurt Manufacturing Health Assessment. Minnesota Department of Health. April 10, 1989**
- 7) **Draft Naval Industrial Reserve Ordinance Plant Public Health Assessment..Agency for Toxic Substances and Disease Registry /Minnesota Department of Health, June 1999**
- 8) **Lindstrom, A.B. and Pleil, J.D. "A methodological approach for exposure assessment studies in residences using volatile organic compound contaminated water". Journal of the Air & Waste Management Association, 46: 1058-1066. November 1996**
- 9) **McKone, T.E., "Household Exposure Models". Toxicology Letters, 49: 321-339. 1989.**
- 10) **McKone, T.E. and Knezovich, J.P. "The transfer of trichloroethylene (TCE) from a shower to indoor air: experimental measurements and their implications". Journal of the Air & Waste Management Association, 41: 832-837. June 1991.**
- 11) **Municipal Well Pumpage Spreadsheet, Community Water Supply Anoka County. Well Head Protection Data Volume 1. September 1999.**

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Figure 2

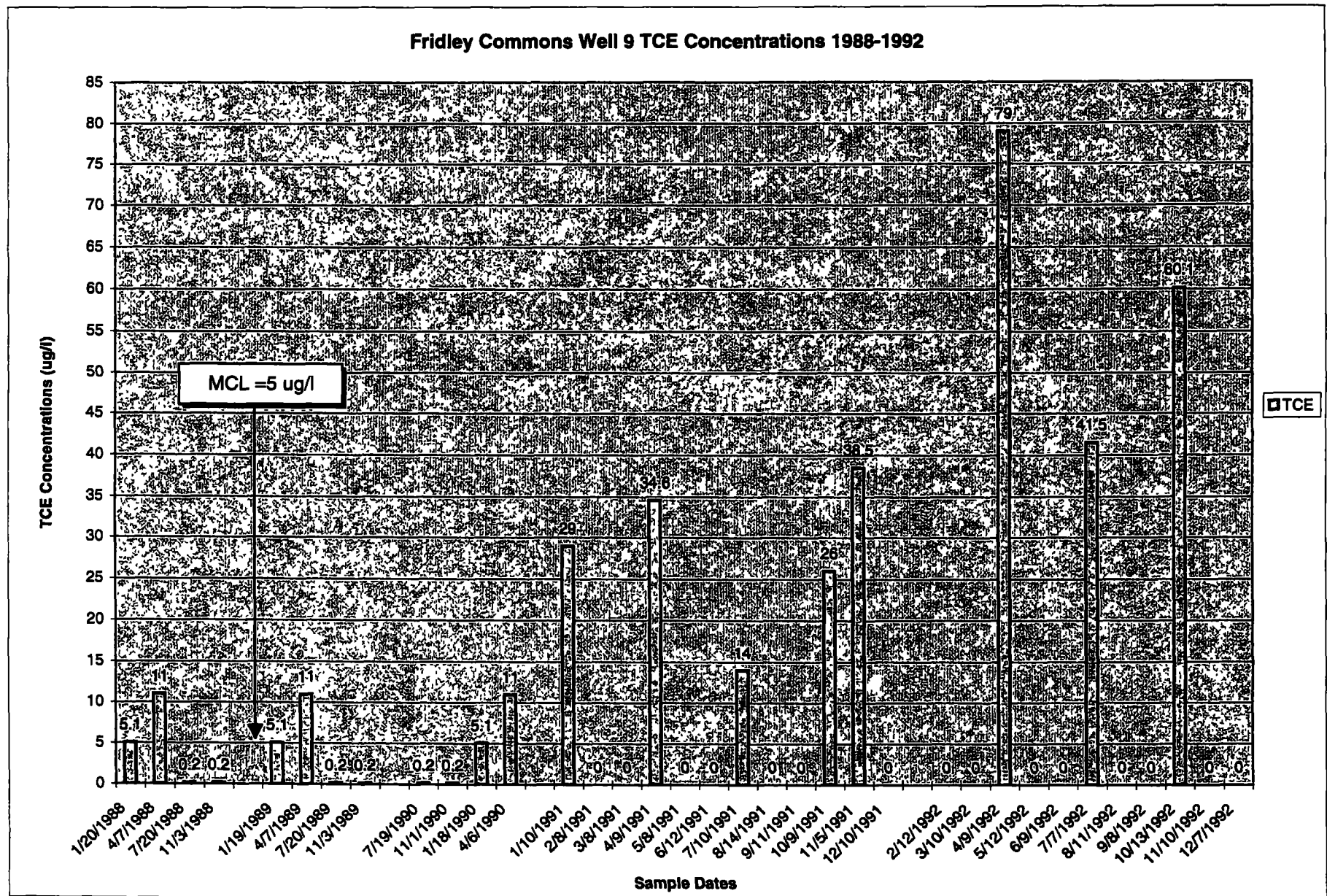


Figure 3

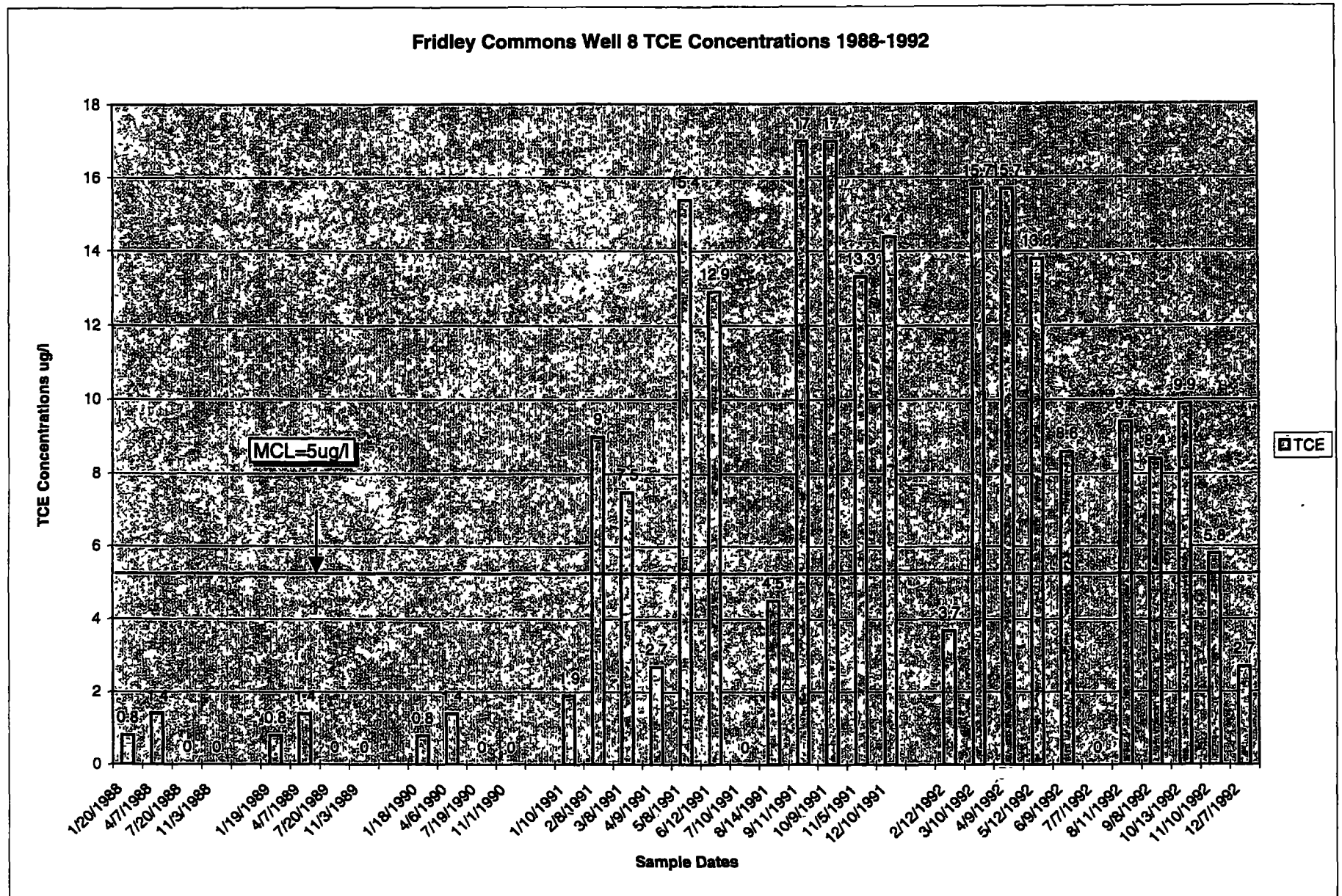


Figure 4

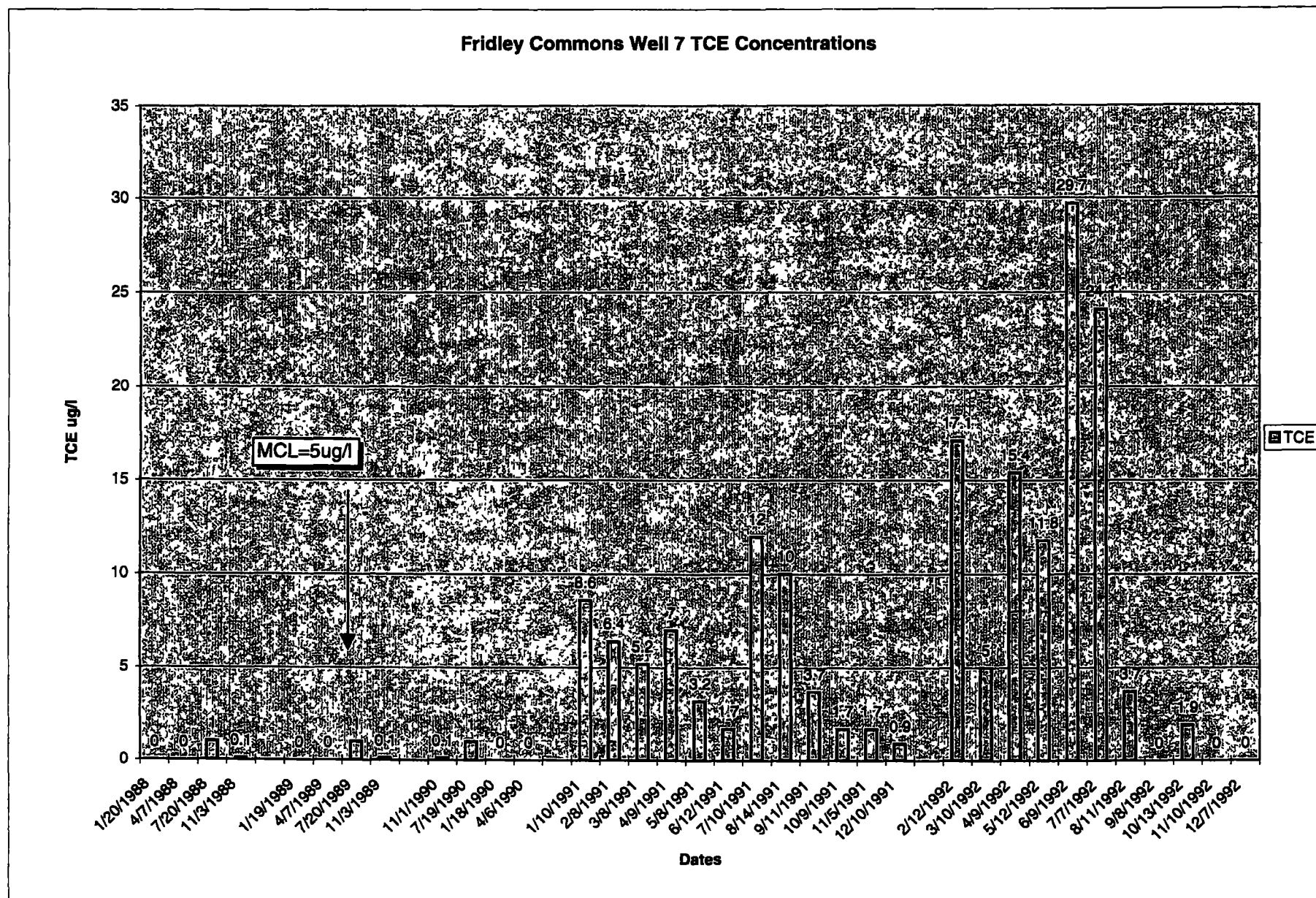


Figure 5

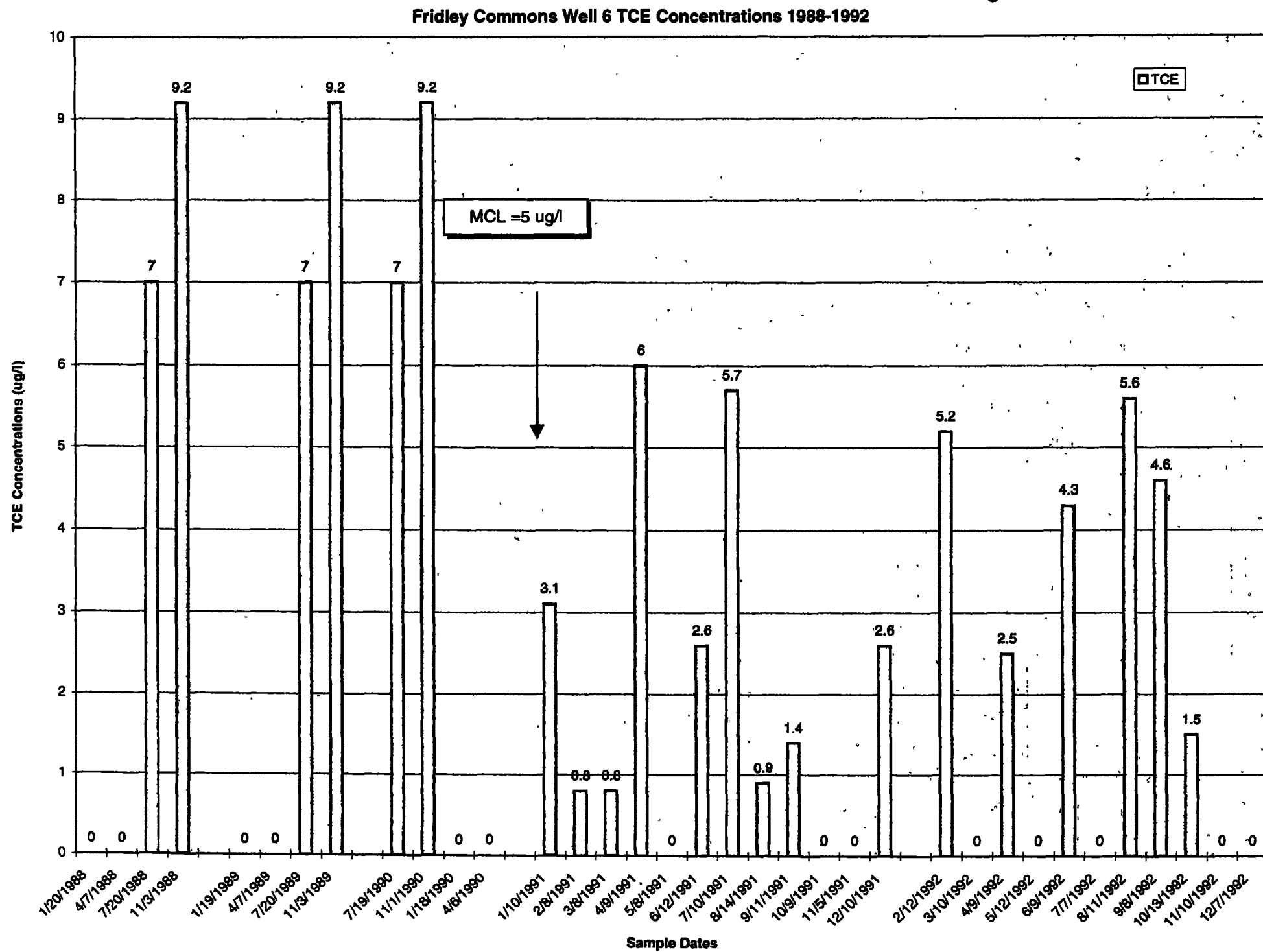
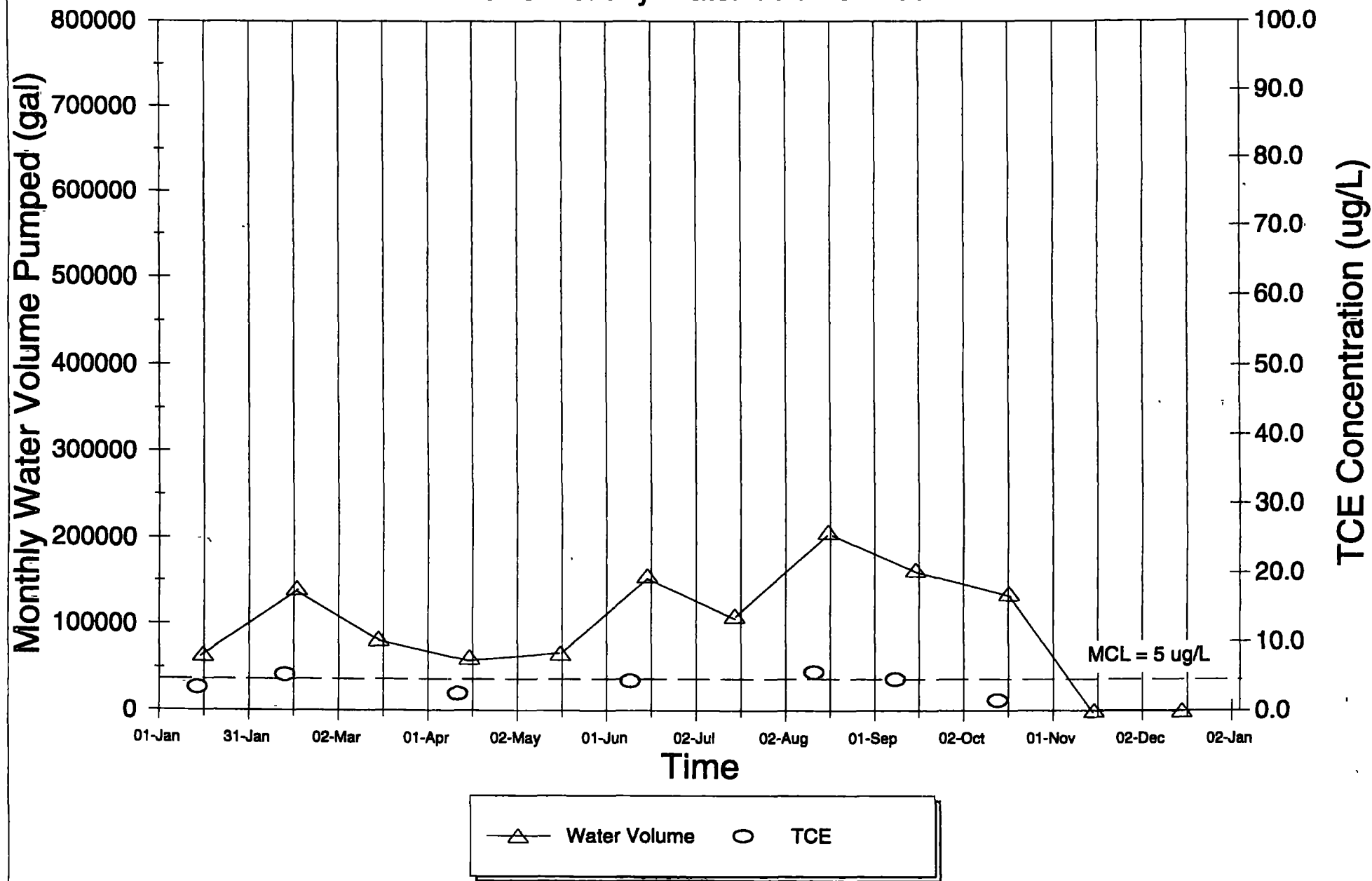


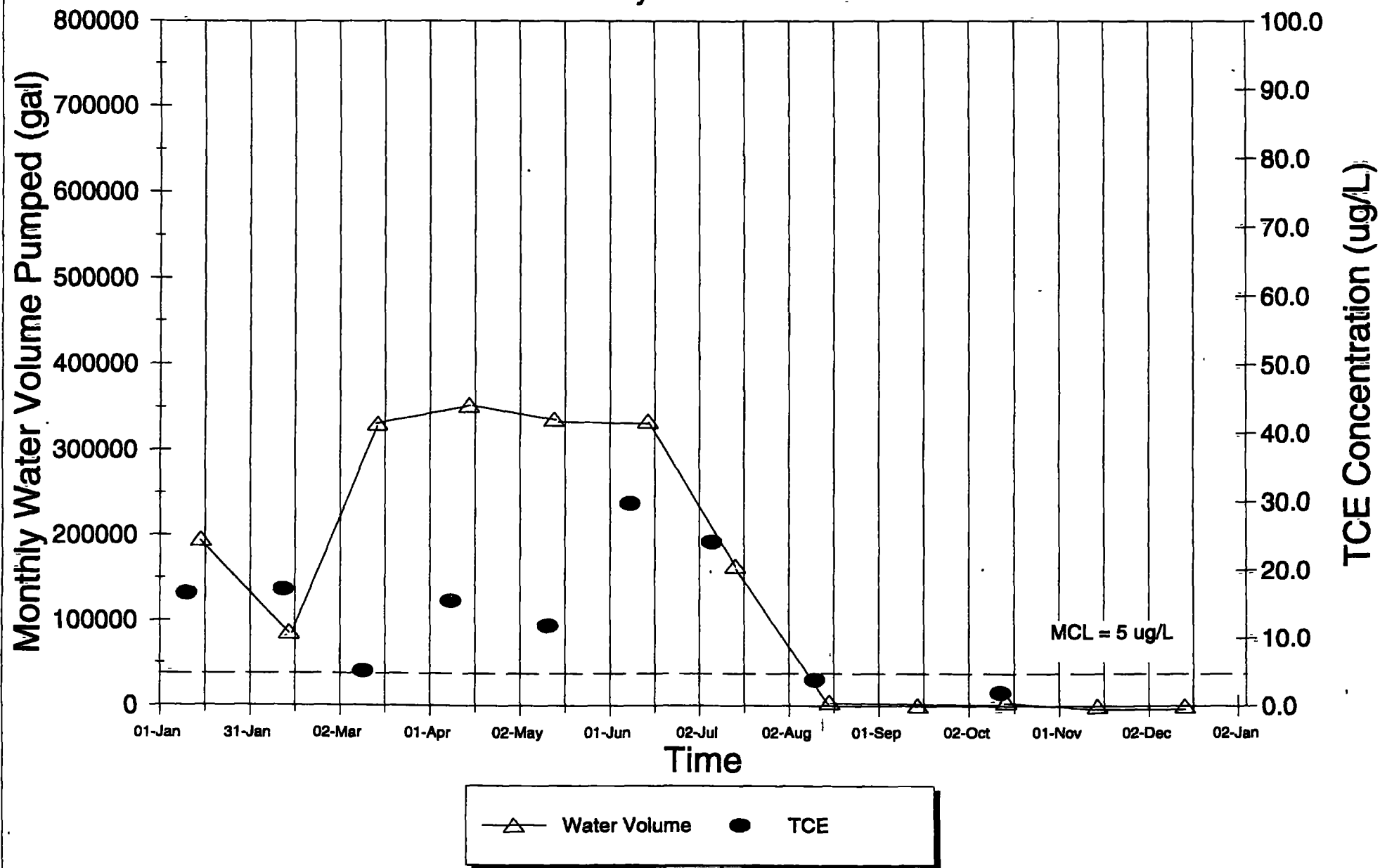
Figure 6

Well 6 Monthly Water Volumes-1992



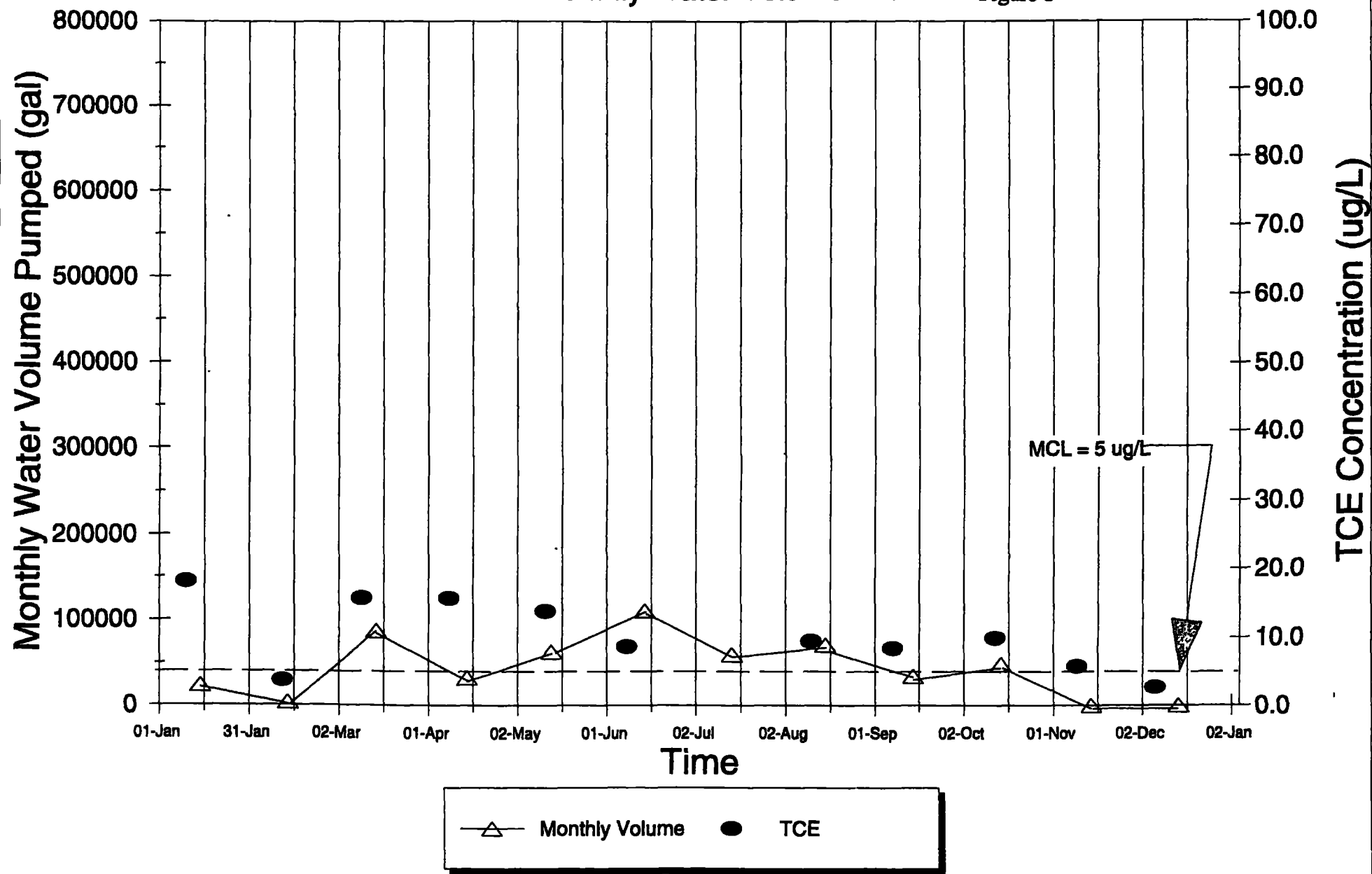
Well 7 Monthly Water Volumes-1992

Figure 7



Well 8 Monthly Water Volumes-1992

Figure 8



Well 9 Monthly Water Volumes-1992

Figure 9

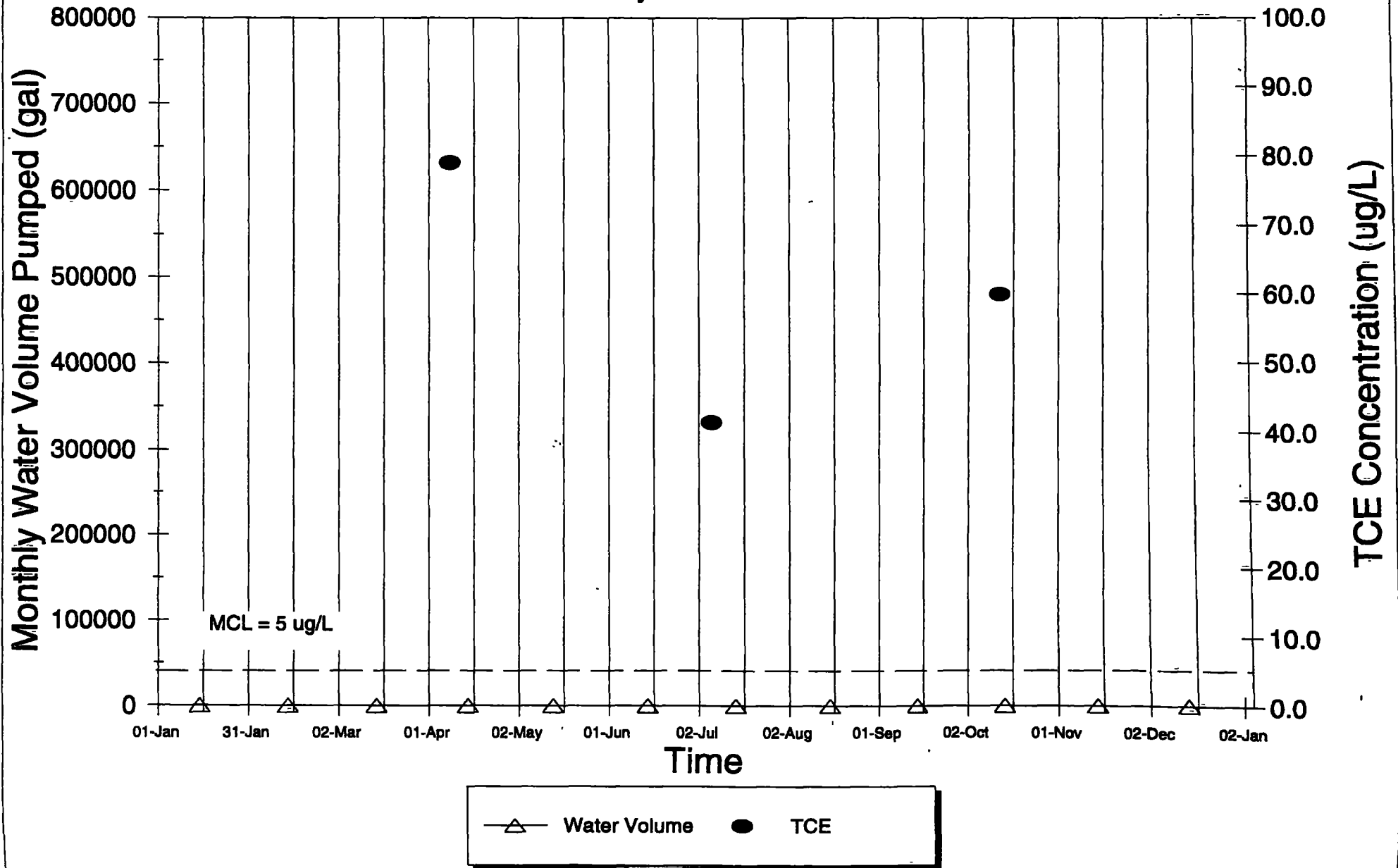


Figure 10

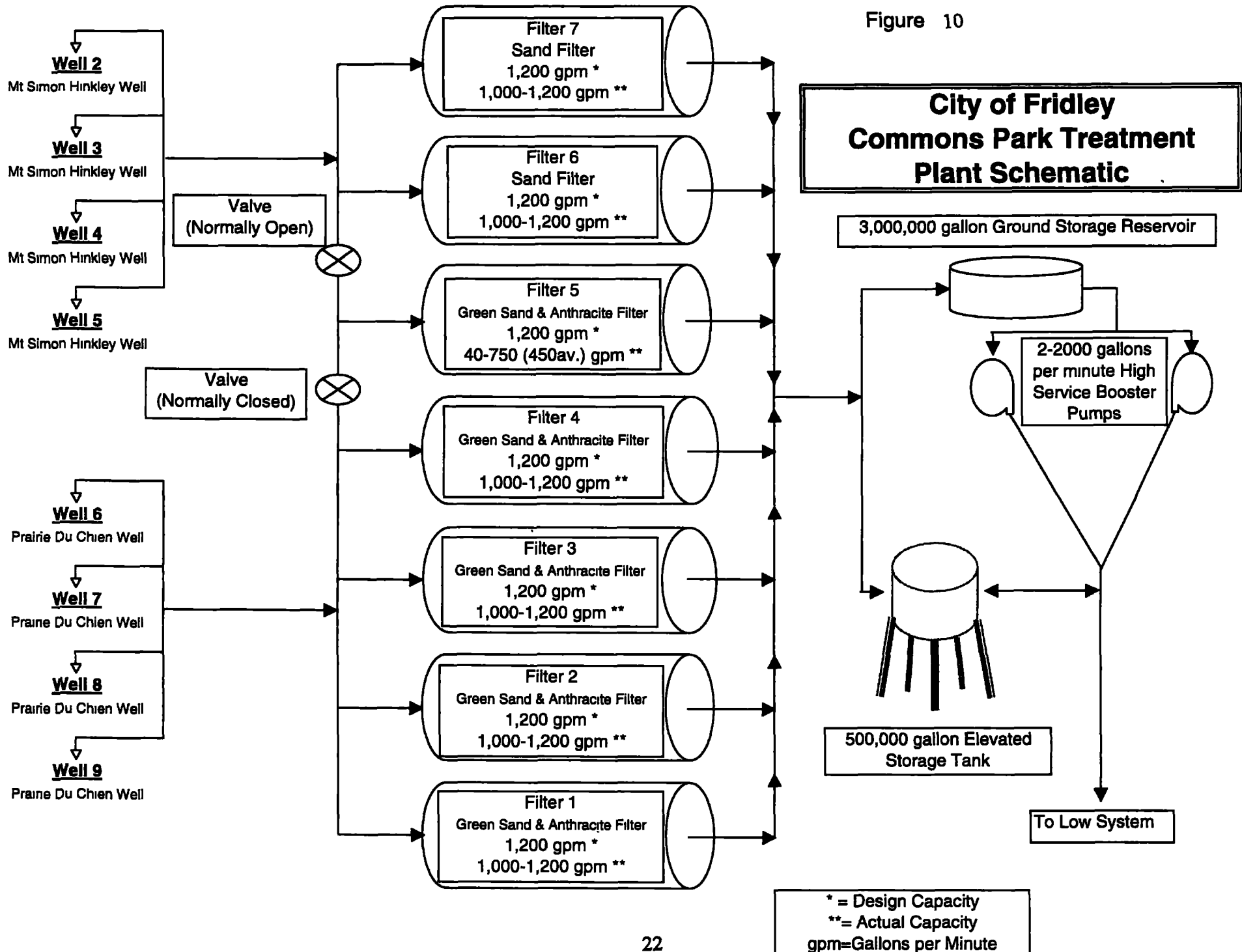
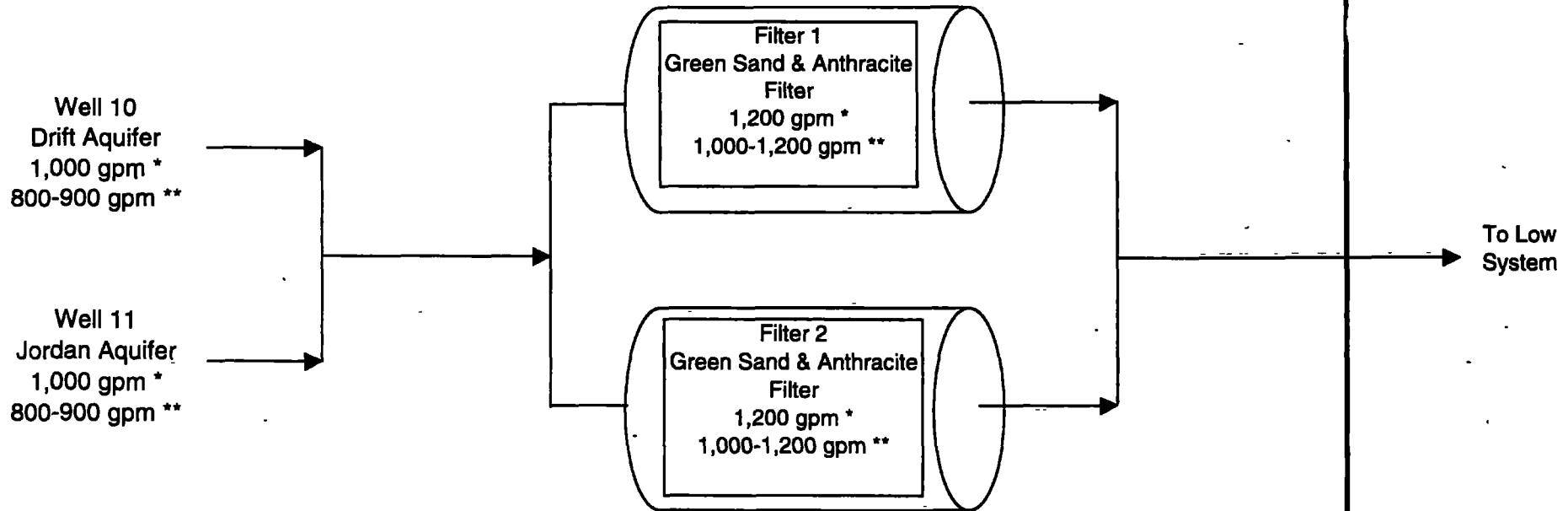
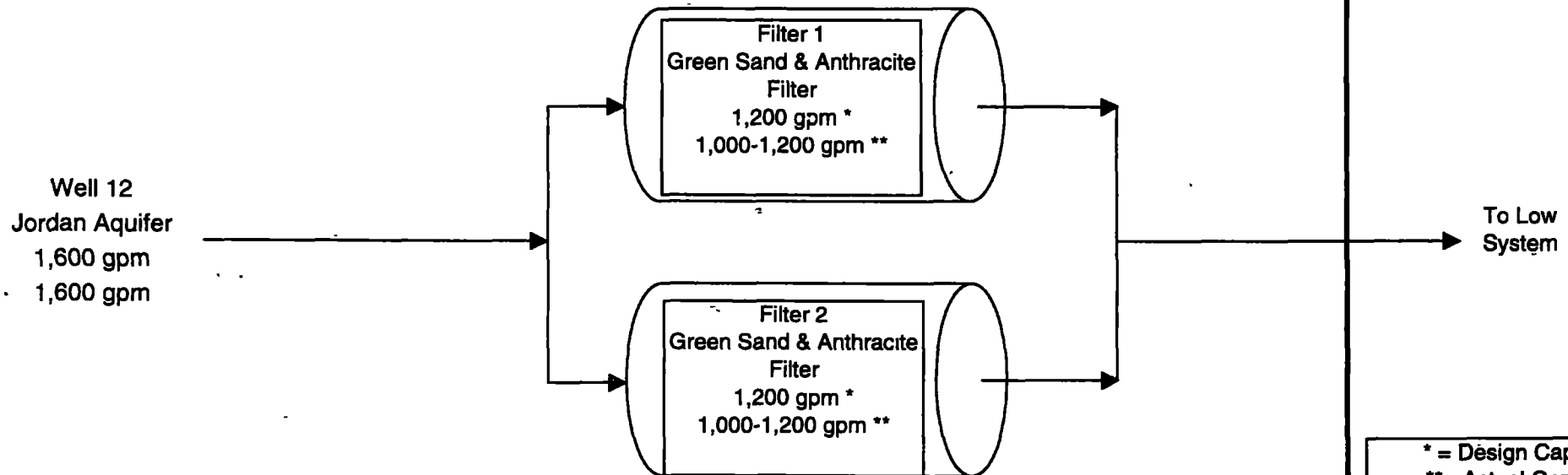


Figure 11

City of Fridley Locke Park Filter Plant and Wells



City of Fridley Treatment Plant 3



* = Design Capacity
** = Actual Capacity
gpm = Gallons per Minute

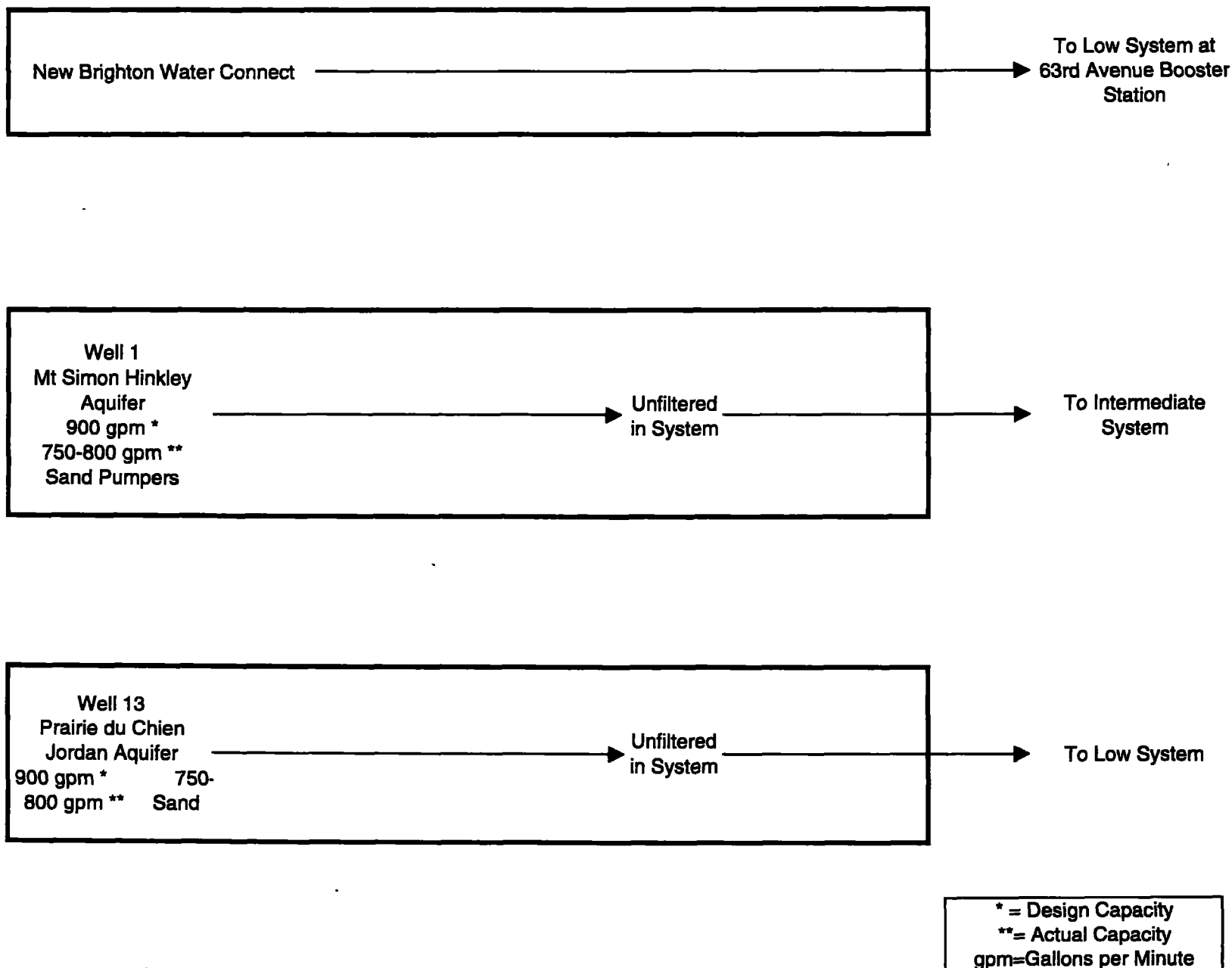
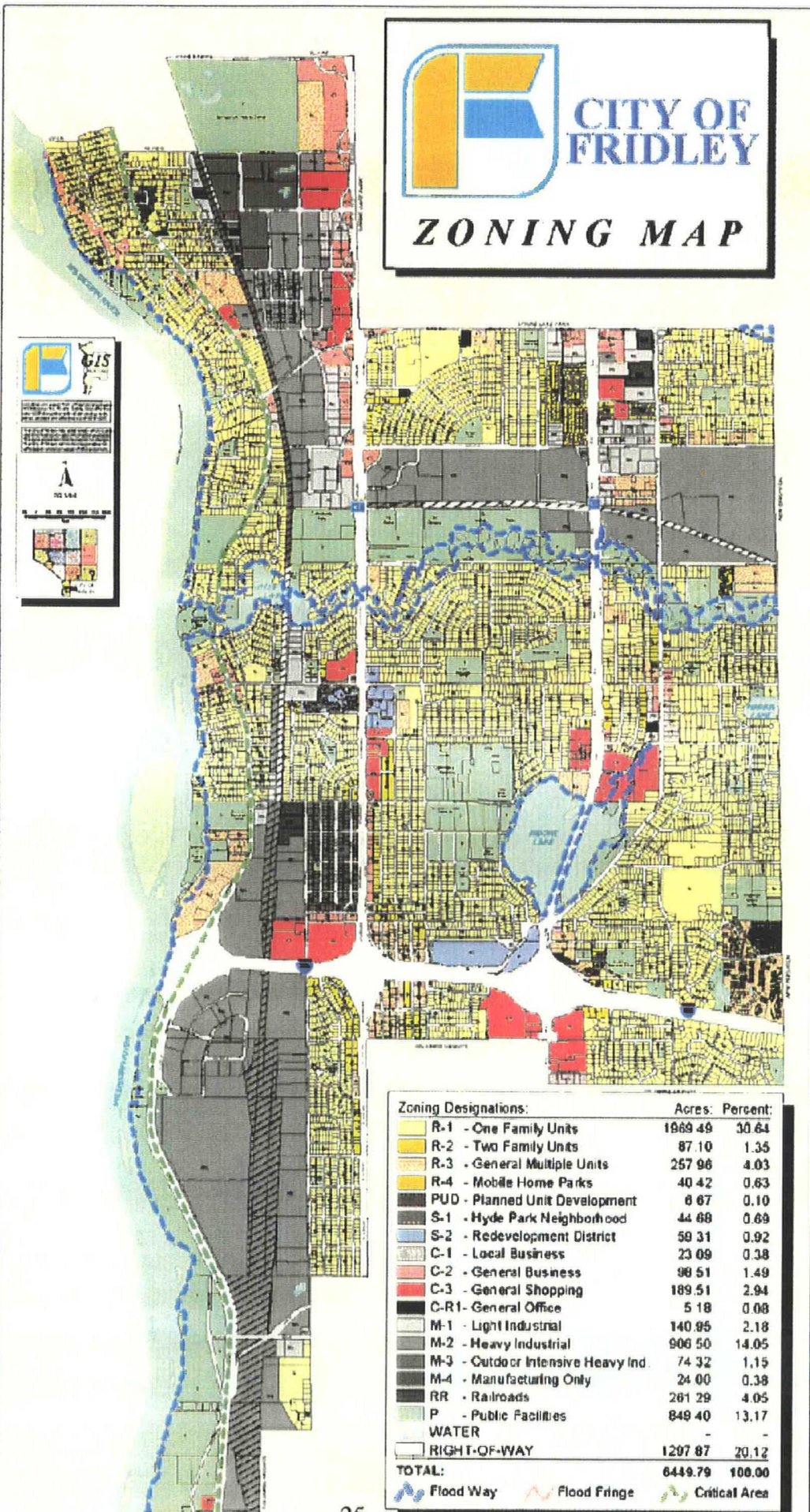


Figure 13



2 PAGES REMOVED
DUE TO EXEMPTION 9